

Master of Science in Biomedical Engineering (BME)

Department of Biomedical, Industrial & Human Factors Engineering, Wright State University

MSBME Focus Areas

Biomaterials: For students interested in tissue engineering and nanomedicine for the development of constructs with polymers and stem cells for tissue regeneration (heart, chronic wounds, bone, central nervous system) or nanoparticles for treating several types of cancer and atherosclerosis. Emphasis is placed on the selection of biomaterials and cell types to optimize tissue regeneration, diseased tissue targeting and treatment.

Advisors: Dr. Tarun Goswami, Dr. Jaime Ramirez-Vick

Medical Imaging: For students interested in designing medical imaging equipment and in extracting diagnostic information from medical images and signals. Emphasis is placed on optical imaging, particularly diffuse optical imaging, as well as magnetic resonance and ultrasound imaging. Medical imaging applications include neuroimaging, particularly monitoring brain function during resting state and neuromodulation, as well as cancer imaging, particularly noninvasive diagnostic imaging biomarkers, image-guided interventions and predicting the intervention response

Advisors: Dr. Ulas Sunar, Dr. Nasser Kashou

Biomedical Systems Engineering: For students who want to follow a more generalized degree path.

Advisor: Dr. Jaime Ramirez-Vick

Medical Devices: For students interested in medical devices, such as design and manufacturing of orthopaedic implants, biomechanics and modeling, or human factors of medical instrumentation and devices. Emphasis is placed on the biomaterials, biomechanics, and biocompatibilities of devices that aim to improve the quality of life of patients with conditions such as trauma, degenerative disease, fractures, and joint arthritis, with the goal to restore functionality and mobility and reduce pain, while considering patient safety and product usability.

Advisors: Dr. Caroline Cao, Dr. Tarun Goswami, Dr. Jaime Ramirez-Vick, Dr. Ulas Sunar

Neuroengineering: For students interested in neuroergonomics and human engineering. Provides courses related to principles, computational methods and technologies in the area of neuroengineering. Emphasis is placed on using engineering techniques to understand, design, and analyze the neural-system interface.

Advisors: Dr. Caroline Cao, Dr. Sherif Elbasiouny, Dr. Subhashini Ganapathy, Dr. Nasser Kashou, Dr. Ulas Sunar

MSBME Degree Requirements

- 30 semester credit hours (thesis optional)
- 18 credit hours of BME courses (6000- or 7000-level)
- 12 credit hours of 7000+-level BIE Department courses
- 6 credit hours of approved courses with math/statistics content
- BME/IHE 6010 Ethics in Engineering Research & Practice (1 cr)
- maximum of 4 credit hours of independent study
- Non-thesis research option: max 6 credit hours of non-thesis research
- Thesis option: max of 8 credit hours of thesis research
- Students must have an approved Program of Study before the end of the first semester. Students can combine focus areas to customize a program of study to suit individual interests. Additionally, full-time or part-time study, evening and distance education classes are available. Graduate teaching and research assistantships are awarded on a competitive basis for qualified students.

Prerequisite coursework: Students should expect to be prepared for their program with knowledge of topics such as calculus, differential equations, linear algebra, statistics, calculus-based physics, chemistry, computations/programming, statics, circuits, linear systems, anatomy, physiology, and/or other core engineering courses, depending on the student's chosen focus area.

Biomaterials

Required Courses			Cr Hr
BME 6010	Ethics*	F/S	1
BME 6440	Biomaterials	F	4
			5
Math Requirement (at least 2)			
BME 7521	Advanced Biotransport* (m)	F	3
EGR 7050	Design & Analysis of Egr Experiments*(m)	F	3
IHE 6150	Probability & Statistics*(m)	F	4
IHE 7300	Research Methods in HFE*(m)	S	3
IHE 7510	Data Mining*(m)	F	3
			6-7
Focus Area Electives			
BME 6421	Biotransport*	S	3
BME 6450	Tissue Egr & Regenerative Medicine*	S	3
BME 6460	Nanomedicine Fundamentals*	S	3
BME 7210	Orthopaedic & Prosthetic Engineering	F	3
BME 7220	Experimental Orthopaedic Engineering	S	3
BME 7370	Medical Devices	F	3
BME 7371	Failure Analysis of Medical Devices	S	3
BME 7930	Non-thesis Research (max 6 cr)	F/S/R	1-4
BME 7980	Special Topics	F/S/R	3
BME 6990/7990	Independent Study in BME (max 4 cr)	F/S/R	1-4
EGR 7020	Systems Engineering & Analysis*	S	3
Or as approved by the advisor			18-19

Medical Devices

Required Courses			Cr Hr
BME 6010	Ethics*	F/S	1
BME 7370	Medical Devices	F	3
BME 7371	Failure Analysis of Medical Devices	S	3
			7
Math Requirement (at least 2)			
BME 7110	Biomedical Signals (m)	F	3
EGR 7050	Design & Analysis of Egr Experiments*(m)	F	3
IHE 6150	Probability & Statistics*(m)	F	4
IHE 7300	Research Methods in HFE*(m)	S	3
IHE 7510	Data Mining*(m)	F	3
			6-7
Focus Area Electives			
BME 6310	Ergonomics*	F	3
BME 6350	Computational Neuroergonomics*	F/S	3
BME 6421	Biotransport*	S	3
BME 6440	Biomaterials	F	4
BME 6450	Tissue Egr & Regenerative Medicine*	S	3
BME 6460	Nanomedicine Fundamentals*	S	3
BME 6550	Bioinstrumentation	F	4
BME 7210	Orthopaedic & Prosthetic Engineering	F	3
BME 7220	Experimental Orthopaedic Engineering	S	3
BME 7850	Lean Process Improvement for Engineers*	S	3
BME 7930	Non-thesis Research (max 6 cr)	F/S/R	1-4
BME 7980	Special Topics	F/S/R	3
BME 6990/7990	Independent Study in BME (max 4 cr)	F/S/R	1-4
EGR 7020	Systems Engineering & Analysis*	S	3
IHE 6300	Fundamentals of HFE*	F	3
IHE 6320	Human-System Interaction & Usability Egr*	S	3
IHE 6510	Computer Applications in IHE	S	4
IHE 7340	HFE in Mobile Computing	F	3
Or as approved by the advisor			16-17

MSBME program of study requirements (all focus areas)

30 credit hours total, to include:

18 credits BME specific coursework (6000- or 7000-level)

12 credits 7000-level BIE Department coursework

6 credits math-intensive coursework

4 credits max. independent study

8 credits max. thesis OR

6 credits max. non-thesis research

Medical Imaging

Required Courses			Cr Hr
BME 6010	Ethics*	F/S	1
BME 6703	Medical Imaging	F	4
BME 6710	Optical Imaging	F	3
BME 7110	Biomedical Signals (m)	F	3
BME 7112	Processing of Medical Images	S	3
			14
Math Requirement (at least 1 in addition to BME 7110)			
CS 5260	Numerical Methods for Computational Science	F/S	3
EGR 7050	Design & Analysis of Egr Experiments*(m)	F	3
IHE 6150	Probability & Statistics*(m)	F	4
IHE 7510	Data Mining*(m)	F	3
STT 6300	Biostatistics	F	3
			3-4
Focus Area Electives			
BME 6720	Biomedical Optics	S	3
BME 7131	Medical Ultrasonics	S (e)	3
BME 7132	Computed Tomography	S (o)	3
BME 7930	Non-thesis Research (max 6 cr)	F/S/R	1-4
BME 7980	Neurophotonics & Optical Brain Mapping	S	3
BME 7980	Research Seminar in Biomedical Imaging	S	1
BME 7980	Special Topics	F/S/R	3
BME 6990/7990	Independent Study in BME (max 4 cr)	F/S/R	1-4
EE 7150	Digital Image Processing	F	3
EGR 7020	Systems Engineering & Analysis*	S	3

Or as approved by the advisor

12-13**Neuroengineering**

Required Courses			Cr Hr
BME 6010	Ethics*	F/S	1
BME 7380	From Neurons to Behavior in Health & Disease	S	3
IHE 6350	Computational Neuroergonomics*	F	3
			7
Math Requirement (at least 2)			
BME 7110	Biomedical Signals (m)	F	3
BME 7521	Advanced Biotransport* (m)	F	3
EGR 7050	Design & Analysis of Egr Experiments*(m)	F	3
IHE 6150	Probability & Statistics*(m)	F	4
IHE 7300	Research Methods in HFE* (m)	S	3
IHE 7510	Data Mining*(m)	F	3
			6-7
Focus Area Electives			
BME 6310	Ergonomics*	F	3
BME 6421	Biotransport*	S	3
BME 6703	Medical Imaging	F	4
BME 7112	Processing of Medical Images	S	3
BME 7131	Medical Ultrasonics	S (e)	3
BME 7210	Orthopaedic & Prosthetic Engineering	F	3
BME 7220	Experimental Orthopaedic Engineering	S	3
BME 7371	Failure Analysis of Medical Devices	S	3
BME 7930	Non-thesis Research (max 6 cr)	F/S/R	1-4
BME 7980	Neurophotonics & Optical Brain Mapping	S	3
BME 7980	Special Topics	F/S/R	3
BME 6990/7990	Independent Study in BME (max 4 cr)	F/S/R	1-4
EE 7150	Digital Image Processing	F	3
EGR 7020	Systems Engineering & Analysis*	S	3
IHE 6300	Fundamentals of HFE*	F	3
IHE 7360	Cognitive Systems Engineering*	S	3
IHE 7370	Medical Devices	F	3

Or as approved by the advisor

16-17**Biomedical Systems**

For students who wish to follow a more generalized degree path. Students will choose 6+ credits of required coursework from one other focus area and fulfill MSBME program of study requirements as approved by the advisor.